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*fall
flowers*

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Fall Flowers

By VERNE N. ROCKCASTLE

FALL is the time for raking leaves, for playing football, for turning back the clocks, and for the first frosts to whiten roofs and cartops. You can probably think of dozens of things that mean fall to you—the shortening of the days, the coloring of leaves, the World Series, corn shocks, and jack o' lanterns. List some other things that you associate with fall. Now list some of the things that you associate with spring. Did you write any things on both lists? Flowers, for example? Perhaps your fall list does not contain flowers. It should, though, because some of our most beautiful flowers do not blossom until after your summer vacation is over. Just as spring is a time for daffodils, trilliums, hepaticas, jack-in-the-pulpits, and pussy-willows, fall is a time for goldenrods, asters, chrysanthemums, and thistles. It is about these fall flowers that this Leaflet is written.

The Sun Controls The Season

On December 23rd of last year, the daylight lasted a few seconds

longer than it did on December 22nd. By March each day had about three minutes more daylight than the preceding day. The sun's path climbed higher and higher in our sky as winter passed and summer approached. By Easter you no longer needed to turn on the lights at breakfast time. Then, on a certain day in April you "lost" an hour's sleep. The clocks were all turned ahead so that seven o'clock would be eight o'clock for several months. This was done in order to make daylight available for most persons' activities (to make working hours sunlit hours). It provided for more daylight at the supper table and less light at the breakfast table. It did not make the day longer, but merely shifted our time-table into the daylight hours.

All through the month of May, and most of the way through June, the sun continued to climb steadily in the sky. Bloodroot bloomed along the hedgerows; mustard and daisies bloomed in the fields. By the time your school recessed for summer vacation,

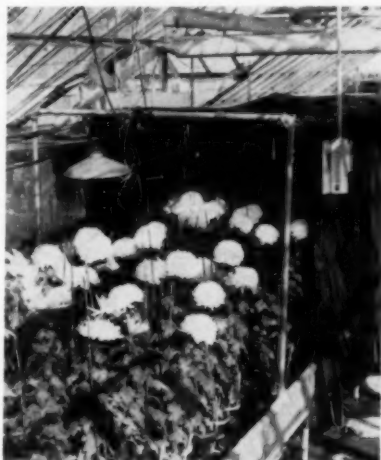
For about three months after June 21st, the days are longer than the nights, but each successive day is shorter than the preceding one. During summer days such plants as milkweed, cinquefoil, mallow, buttercups, and hollyhocks blossom. An occasional aster or thistle may add a dash of purple to an otherwise yellow, pink and blue summer. When summer draws to a close, some persons think that the flowering season is over. For many flowers this is true, but for others one of the flowering peaks of the year is yet to come. Many fall flowers do not bloom until the days and nights are of nearly equal length. At least one, witch hazel, does not bloom until after its leaves have fallen. You will read about it on page 30. Nearly all flowers need light for proper growth, but the length of daylight is critical for the blossoming of some plants.

Man Controls Fall, Too

Scientists have learned by experimenting with fall flowers that certain ones form their buds when the daylight is about 14 hours long, but will not form them when the daylight is longer. (This is the same as saying that their buds form when the nights are only about 10 hours long, but no shorter.) In mid-

June the days are more than 14 hours long and the nights are correspondingly shorter. The buds of asters and chrysanthemums cannot form under these conditions, but must wait until later in summer when the days are shorter (or the nights longer.)

Florists are quick to take advantage of this dependence on day-length. If they want chrysanthemums to bloom in July, they shorten the June days by placing black cloth over the plants for a few hours each day. Thus the plants are artificially darkened at just the right time each day, so that their day-length is about 14 hours. This causes



This cloth hood is used to shorten the days and make the "mums" bloom

however, the longest day of the year (usually June 21) had come and gone and the sun had begun to move back toward the southern horizon. It never did get directly overhead here in New York State. Why? On July 21st the sun was only as high as it had been on May 21st. Musk mallow, phlox, and roses added their pinks, purples and reds to the floral scene.

Now it is fall. The days are noticeably shorter. It may even be necessary to turn on the lights for supper. It is dark by bedtime. By September 21st the day and night are of equal length. From that time until nearly Christmas the nights, already longer than the days, will become even longer. The summer flowers have nearly all gone to seed. The cicadas have ceased their singing in the treetops. The store windows are displaying fall fashions, and a sweater feels good when you are out-of-doors. The changes in daylight, in weather, in sports, and in your activities tell you that warm days are soon to become cold ones.

Some persons think that the arrival of fall is the end of flowers. How wrong they are! This is the time for a whole group of plants to blossom. Spring flowers may be impressive because they present the first dash of color

after a long, colorless winter. A look at the fall countryside, however, will show you some of the most beautiful sights that plants can offer. . . . "with the yellow and the purple and the crimson keeping time."

By Halloween the nights are about three hours longer than the days. By Thanksgiving they are about five hours longer. Many plants that were in bloom when school re-opened are now forming their seeds to tide them over the winter. The sun's path sinks lower and lower as December 21st approaches, then begins the long climb back up in our sky as next spring and summer approach. This cycle of the sun regulates the length of the day and night, the seasons, the weather, many animals, and many plants. You are probably familiar with such animal behavior as migration, hibernation, molting, and other seasonal activities. Few persons are aware, however, that many plants exhibit equally pronounced seasonal changes.

Some flowers bloom in spring, when the day is lengthening, but is still shorter than the night. When trilliums, hepaticas, jack-in-the-pulpits, crocuses, daffodils, tulips, and pussy-willows are in blossom, many of the plants that bloom in fall have not pushed their leafy parts above ground.

ers, and the dandelion. Many of these composites flower during the fall, when the day is shortening and the night is growing longer. You will see many of them this fall. You will need to work hard to keep certain of them from taking over your lawn and garden. They are such important plants, both as weeds, and as cultivated flowers, that they are worthy of study.

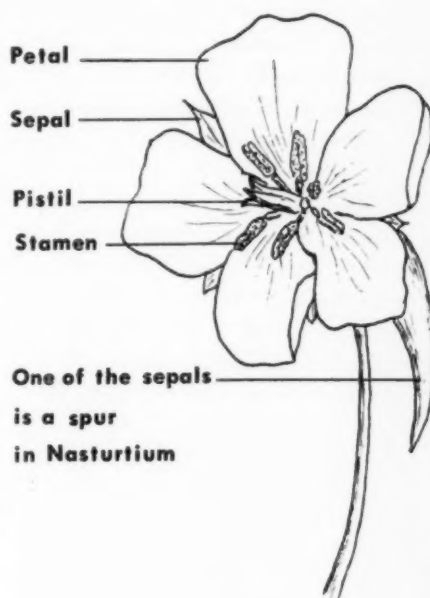
What Is a Flower?

In order to understand a composite flower, let us first review the parts of a simple flower. You may have learned that a complete flower has four parts or sections as shown in the diagram on this page. The *sepals*, often green, are the outermost part of the flower. All the sepals of a single blossom are called the *calyx*. They are the outer covering of a rosebud, the hull of a strawberry, and the fuzzy base of a hollyhock blossom. Can you find the calyx (sepals) of a snapdragon or an African violet? The green covering of a dandelion bud, and the calyx-like structure below an aster blossom look like sepals, but really aren't. You will learn about them on page 13.

The *petals* are the most brilliantly colored parts of most flowers. All the petals of a single flower are called the *corolla*. Most

garden flowers are grown because of the beauty of their corolla (petals). Occasionally a flower has colored sepals, but no petals, though only a trained botanist would recognize such an exception to the rule. Some petals have small glands near their base that secrete nectar. Bees, flies, and other insects often probe among the petals seeking the sweet oozing from these nectar glands.

The *stamens* are the male flower parts. Most flowers have more than one stamen and they are usually found in a cluster inside the corolla. A stamen usually consists of a slender thread-like *filament* that supports a pollen sac or *anther*. Look for the stamens on such plants as roses, lilies, snapdragons, hollyhocks,



their buds to form. Further decreasing of the day-length causes the flower to open, and soon the florist has blossoms for sale.

Just as the summer day can be shortened by using black cloth, the winter day can be lengthened by using artificial light. Chrysanthemum growers can turn on lights over the plants and thus make their day long enough for bud formation. Decreasing the daylight after the buds have formed makes them open. You may buy chrysanthemum blossoms at nearly every season, thanks to their dependence upon day-length.

Recently scientists learned that interrupting the night for just a few minutes has an effect similar to shortening the entire night or lengthening the day. If the day is much longer than 14 hours, the buds of chrysanthemums will not form. Or if the night is very short they will not form. A grower can thus either add extra hours to the natural day by using artificial light, or he can shorten the night by interrupting it for a few minutes with artificial light. Which would be more economical if he wished to prevent or slow down the bud formation of chrysanthemums in order to make them blossom after the normal season?

You may be interested to know that poinsettias, the popular Christmas plant, need at least a 12-hour night in order to blossom. Even a minute or two of light in the middle of the night will prevent flowering. One greenhouse where poinsettias were being grown for Christmas was located near a bend in a highway. The lights of cars rounding the bend shone in the greenhouse enough to interrupt the night and thus upset the grower's schedule.

Perhaps you will want to do some home experiments of your own, using dark cloth or artificial light. You will find it interesting to regulate the flowering time of chrysanthemums by providing them with artificial days and nights. Your local florist or greenhouse owner may be able to advise you in your experimentation. You may be one young scientist who can add to the little that is known about long-day and short-day plants.

Composites Are Bouquets of Flowers

Among all the many kinds of fall flowers, one family is outstanding. This is the composite family—the family that includes the goldenrods, the asters, the chrysanthemums, the sun-flow-

from the blue-flowered chicory that grows in weedy places. How many petals does your blossom have? How many sepals? Can you find the pistil? The stamens? You cannot find a single pistil or a cluster of stamens? Aha! You cannot find them because your blossom is a special one. It is not a single flower as many persons think. Instead, it is a bouquet! It is a whole cluster of tiny flowers (called *florets*) all attached to a single receptacle. Each petal-like floret of your dandelion or chicory blossom is a tiny flower containing the stamens and the pistil that were difficult to find.

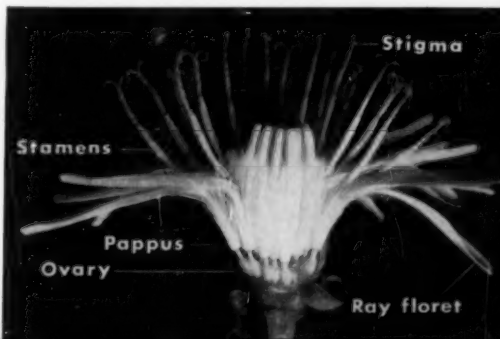
You can see for yourself how different a composite blossom is from other flowers by breaking your blossom in two as shown on the right. Can you see that the blossom, called a *head*, is composed of many florets, each with a strap-shaped corolla like that shown on page 10? Florets that bear such corollas are called *ligulate florets* because the corolla ends in a flattened part called a *ligule* (lig'-yule). They are more often called simply *ray florets*. Dandelion blossoms and chicory blossoms are bouquets of ray florets. The devil's paintbrush described on page 17 is also a bouquet of ray florets. The "petals" of daisies and asters are ray florets, too. Later, you will learn

about a different kind of floret that many composites have.

Carefully remove a single ray floret from the head. The diagram on page 10 shows you what a single floret looks like. Can you find the white, swollen ovary at the bottom? Here is where the fruit with its one seed will develop. Look for the split, curled stigma. This is at the tip of the pistil. Perhaps you can even see some pollen grains sticking to its surface. A magnifier will help you see them. Between the stigma and the ovary is the style. Can you find it? But you cannot see any stamens, can you? They are well-hidden. A steady hand, a pair of sharp eyes, and a magnifier will help you find them.

The anthers (remember, they are the pollen sacs of the stamens) look like a slender swelling about the style, just below the stigma. They seem to be a part of the style, but they are not. Actually, the anthers of a floret such as yours are all connected to each other so as to

In section, a dandelion blossom is found to be a bouquet of florets





Not one but many pistils are packed in the center of the fall anemone

and African violets. They are present in asters and dandelions, too, but they are well hidden. You can read about how to find them on page 9.

In the center of most flowers is a structure that may resemble a small, greenish bowling pin. This is the *pistil*, the female part of the flower. Its swollen base is the *ovary*, where the seeds develop. The sticky tip of the pistil, often split or fuzzy, is the *stigma*. This is where the pollen grains land and begin to grow their root-like tubes downward to fertilize the undeveloped seeds. Connecting the ovary and the stigma is the stalk-like *style*. Often the pistil of a flower will have several lengthwise sections joined to-

gether so that they look like a single structure. If you cut through the ovary of such a pistil you can see the sections, with seeds in each. A tomato is an example of such an ovary. Can you see that this ovary has several compartments, with seeds in each of them?

Some kinds of flowers such as the anemone, the buttercup and the raspberry have several pistils. In the anemone they are so tightly packed that they look like one large bumpy pistil. In the raspberry, each pistil produces one of the fleshy knobs of the berry.

In order to produce seeds, a flower needs only a pistil and a stamen (the female and the male flower parts). The petals and the sepals serve mostly to attract insects or to protect the vital flower parts. Some flowers, however, have neither sepals nor petals; some have sepals but no petals; some have petals but no sepals. Some have a pistil but no stamens; others have stamens but no pistil. You can find many combinations of these flower parts, and many ways of arranging them on their base or *receptacle*.

Composites Are Bouquets

Some have ray florets. Pick a blossom from a dandelion or

blossom (head). Break open the head as you did with the dandelion or chicory. You may have to use a knife to cut it, so be careful. When you have opened the head, remove one of the florets to compare with the ray floret you have already observed.

The floret of the thistle, like that of a burdock, has a slender tube-shaped corolla instead of a flat, strap-shaped one. Such florets are called tubular or *disc* florets (because they form the disc or center of many composite heads such as asters, sunflowers, and daisies). A composite whose flower heads contain only disc florets is said to be a discoid composite. Thistles and burdock are two common discoid composites.

Carefully split the tubular corolla of a disc floret to expose the rest of the parts. How many lobes (divisions) does the tip of the corolla have? Can you find the pistil and its parts (the stigma at the top, the ovary at the bottom, and the style connecting them)? In what ways is this disc floret similar to the ray floret of chicory or dandelion? In what ways is it different? Can you find the pappus just above the ovary? Notice how much longer are the pappus bristles of the thistle than of the dandelion. What do you think happens to each of the

flower parts as the head matures and finally "goes to seed"? You can learn the story of all these flower parts by examining several thistle blossoms or dandelion blossoms in various stages of maturity. There is a fascinating story inside any composite head, even that of the prickly thistle.

Some have both kinds of florets. The heads of some composites such as the daisy, the sunflower, the aster, and the black-eyed susan contain both ray and disc florets. The ray florets of the daisy are the ones you pick off when you play "rich man, poor man, beggar-man, thief. . .", or "she loves me, she loves me not . . ." Many persons think



The long tubular florets of thistle are pearly white beneath the prickly involucre

form a hollow tube about the style. Inside the pockets of this hollow tube the pollen is produced. Other flowers do not have such an arrangement of the anthers. The filaments can be seen if you will carefully split the corolla and draw its two halves slowly apart.

Your floret has a corolla, stamens and a pistil, but what about sepals? The calyx (sepals) of a floret such as dandelion does not look like the green bud-covers (calyx) of a rose. The bundle of silky hairs that you can see growing from the top of the ovary is part of the calyx. This bundle of hairs, called a *pappus*, is the parachute that helps carry the dandelion fruit away when it is ripe. The pappus of the dandelion floret is only slightly stiff and glistens in the sunlight. The pappus of thistle fruits is called this-tledown. It is much longer than that of dandelions. The pappus of goldenrod is tiny and difficult to see before the floret has "gone to seed." It is particularly visible against a dark wool suit that has been worn through a weedy field.

In some composites the pappus is so short that it cannot help to carry the seed. In others it is completely lacking. Chicory, for example, has a pappus of such tiny scales that they are of no



The fused petals of a ray floret resemble a single long petal (the pappus has been omitted to show the other parts more clearly)

help in carrying off the fruit. Burdock fruits have very short bristles that are difficult to see. They often fall off shortly after the fruit is ripe. Dog-fennel, a weed of the roadsides and barnyards, has no pappus at all. You will find many types and shapes of pappus as you study the composites. In form and structure, some are nearly as beautiful as the florets themselves.

Some have disc florets. You have now examined a ray floret from a dandelion or a chicory blossom. Many composites have another kind of floret. It is so small that most persons would never think of it as a complete flower. A few close observations will show you that it is. Find a thistle plant with a purplish blossom on it. Carefully (the spines are sharp!) pick or cut off a

ets are large and showy and may attract insects. But the disc florets do the real work of carrying the plant from one generation to the next. One of the spring composites, coltsfoot, has fertile ray florets and infertile disc florets. Unlike most composites, the ray florets of coltsfoot produce the fruits. In the daisy, both the disc and the ray florets are fertile.

You cannot always tell by looking at a floret whether it is fertile or sterile. You know, of course, that a floret with no pistil cannot produce a fruit. A floret may have a pistil and no stamens, however, and still be pollinated from other florets that do have stamens. You can learn much about the florets of radiate composites by examining the heads after the fruits have formed. The presence or absence of fruits may help you decide which are sterile and which are fertile florets. You will find that radiate composites are an intricate but fascinating group to study.

The Wall Around the Florets

When you were looking for sepals on a composite head, did you notice the greenish scale-like structures below the florets? These certainly look like sepals, don't they? True sepals, however,

are part of an individual flower (the pappus of a floret, remember?). The green structures below the composite head surround the whole bouquet of florets. They are called *phyllaries* (fill'-a-reez) and help to protect and support the florets above them. All the phyllaries of a single head are often called the *involucre*, meaning the part that surrounds the head. Examine the involucre of several common composites. In some you will find that the phyllaries are in almost a single row. In others there are several rows of phyllaries, over-

This aster is a radiate composite with white ray florets and yellow disc florets



these ray florets are the petals of a single flower. You know now that they are not. The disc florets form the eyes of black-eyed susan, and the yellow center of the daisy.

These composites that have both ray and disc florets are often called *radiate* composites. You may think of them as living sketches of the sun—the ray florets are the sun's rays radiating out from the disc (the sun). How many radiate composites can you find growing around your home or school? Can you find any asters? sunflowers? black-eyed susans (sometimes called brown-eyed susans)? fleabanes? yarrow? daisies? (Daisies do not blossom as late as the goldenrods and asters.) You will have fun testing your knowledge of composites. When you see one, examine its head and try to tell whether it is a ligulate composite (only ray florets), a discoid composite (only disc florets), or a radiate composite (both ray and disc florets). All three types are common in both field and garden.

Just as there are many combinations and arrangements of floral parts in single flowers, there are many combinations and arrangements of florets in radiate composites. Some, such as the



The petals of a disc floret are fused into a slender tube

sunflower, have disc florets that are perfect (they have both stamens and a pistil), but their ray florets have neither stamens nor pistil. Some, such as the aster, have perfect disc florets and imperfect (they lack stamens) ray florets.

The central cushion, or disc, of sunflowers is made up of tiny disc florets that possess both stamens and a pistil (and they are fertile; that is, they can produce seeds). If you examine a sunflower head this fall you will see where the seeds are produced. You will notice that it is not the ray florets that produce the seeds, but the disc florets. The ray flor-



*Burdock gets its name from the hooks
or burs on the involucre*

The botany books will tell you that composites have their flowers in *heads*, with few to many florets attached to a single head; that the *anthers are fused* to form a slender tube about the style; and that the head is surrounded by an *involucre*. Teasel heads, which may at first glance appear to be composites, do not possess an involucre. Can you examine teasel flowers to see whether they have the other two characteristics of composite florets? Of course you do not al-

spiders, or flies, or other small creatures that use the ripened heads as winter homes.

One composite has an involucre that is more showy than the florets themselves. Pearly everlasting, shown on the right, has yellow florets surrounded by a large, pearly involucre. The blossoms are often picked in the fall, dried, and used for winter bouquets. They keep for months without water. The pearly whiteness of their involucre, and their ability to last a long time when dried, give them their name.



*The creamy-white involucre of pearly
everlasting remains long after the
florets have "gone to seed"*

So That Makes a Composite!

You have now seen and studied the characteristics of composites.



The involucre of chicory encloses the unopened blossoms

lapping each other like shingles or like fish scales. In some, the marigold, for example, they are fused (grown together). Botanists often use the involucre to help them identify a strange blossom.

In some plants the involucre gives special protection to the blossom, or helps to scatter the fruits when they are formed. In the thistle blossom that you examined, a prickly involucre enclosed the florets. In the bull thistle, shown on page 11 the involucre is exceedingly spiny and difficult to cut through. In

the Canada thistle it is smaller and not quite so stiff. How many other plants can you find that have spiny involucre around their blossoms?

The involucre of the burdock blossom is not only stiff, but each of the phyllaries ends in a tiny hook. These hooks are soft when the blossom is young, but stiffen as the fruits form within the head. By the time the fruits are ripe the hooks on the involucre are ready to catch in the fur or clothing of a passing animal. When you pick a burdock bur off your clothing and cast it away, you are helping to sow not just one fruit, but all those contained in a single head surrounded by a prickly hooked involucre.

If you open several ripened burs with your fingers you may find some in which several of the fruits seem to be stuck together. Carefully pick one of these clusters apart. Can you find a tiny white larva inside? It is a moth larva that spends the winter in a "tunnel" inside the cluster of fruits that it has glued together, then emerges in the spring. As you examine the heads of composites you will find equally interesting plant-animal associations. In some you may find tiny beetles that overwinter. In others you may find tiny



The spiny head of the teasel looks like an involucre, but isn't

ways need to look for these three characters to determine whether a flower is a composite. If you can recognize dandelions (ligulate composites), thistles (discoïd composites), and daisies (radiate composites), you know the three different types of composites. All composites are represented by these three common flowers.

Composites of Field and Fencerow

One of the most colorful of the fall composites is *goldenrod*. Its yellow florets, although tiny, grow in such masses that they give the fields and roadsides a golden cast in late summer and early fall. As their fruits ripen and the pappus of each tiny flor-

et expands, the yellow changes to a soft white, almost smoky, color. There are many different species of goldenrod. Some have large masses of flowering heads, some only a few heads scattered along their stems, and one is even white instead of yellow. Their tiny heads, usually less than $\frac{1}{4}$ inch in diameter, are radiate. The outer row of ray florets is usually sterile, however, so that fruits are formed by the disc florets near the center of the head.

The florets of goldenrod attract all manner of insect life. The soldier beetles and the locust borers often visit these



Goldenrod is responsible for most of the golden-yellow color of fall fields and roadsides

heads in search of pollen and nectar. Small bees and flies of many species may be found busily probing among the florets. In addition to the insects searching for nectar and pollen, there are predators in search of these insects. One, a small crab spider, is buff colored and matches the color of the florets. It waits patiently among the blossoms ready to pounce upon some unwary visitor. How many other guests can you find among the blossoms of goldenrod?

A frequent associate of the goldenrods is *New England aster*, a beautiful purple and gold composite that grows throughout New York State. Its ray florets are purple and its disc florets are orange or golden. Together with goldenrods, the asters make beautiful and fragrant bouquets for the fall table. Like the goldenrod, asters have frequent insect visitors—bees, small flies, beetles, and an occasional predator such as a crab spider. The asters are radiate composites. As in the goldenrods, their fruits bear a white pappus that helps the late fall breezes scatter them across the fields. They are perennials, so the fruits are not necessary to maintain the plant at one spot, but they do help to spread it over adjoining fields.

Many species of aster grow in our state. Some are small and white, some pale blue, and others pale purple. You may find asters growing along the roadsides, in the fields, or in the woods. Many persons grow asters of several kinds in their gardens. Some double asters have only a small disc or none at all, so only the showy ray florets can be easily seen.

The *hawkweed* is an early fall composite that looks like a small dandelion blossom atop a slender, hairy stem. It is also called devil's paintbrush. Hawkweed grows on dry, poor soils, and its presence can sometimes be taken



New England aster's gold and purple blossoms make it a royal weed

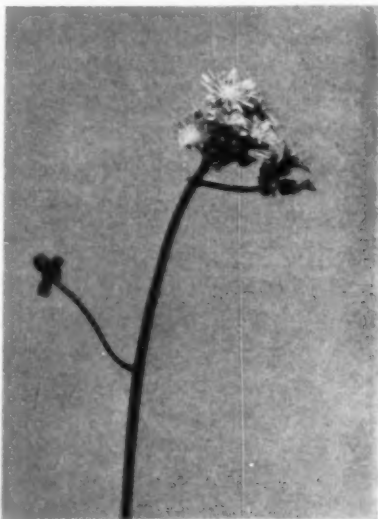
as an indication of poor farming land, or land that has not been properly cared for. If it is a weed of ill omen, its flower is nonetheless beautiful. Its florets are all ray florets, and most produce fruits with effective parachutes. Can you see the resemblance of hawkweed to dandelion? to chicory? Are the fruits similar?

The name hawkweed comes from an ancient belief that hawks used the plant to strengthen their eyesight. Of course you know that this is not true. It is interesting that many plant names have been derived in this manner. You will read about more of them in the Leaflet.

The stem of the hawkweed blossom grows from a leafy rosette that is nearly flat on the ground. This rosette remains green throughout the winter, although the flowering stalk dies back. If you dig down through the soil around one of these rosettes perhaps you can find the stolons (runners) that help to spread the plant. Does the hawkweed need its fruits to reproduce if it has stolons? Do you know of any other plant that reproduces by means of stolons or runners?

A composite so small that it escapes the eyes of many persons is *Frenchweed*, often called *door-*

yard weed. This common weed of gardens and yards has flowering heads only a fraction of an inch across. Five white ray flowers surround a cluster of yellow disc flowers. In structure, it is like a tiny aster or daisy. Although this plant flowers in fall, as well as in summer, it is sensitive to frost and often dies back at the first killing frost. Frenchweed, like many of our other composites, is not native to our country. It was introduced from tropical America many years ago and has succeeded in establishing itself in many gardens (including mine!).

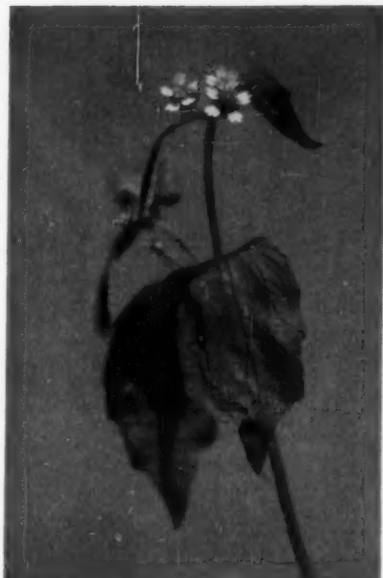


Like the dandelion, the red, orange or yellow heads of hawkweed are all ligulate

You may find it interesting to read about how some of the non-native plants in our country came to be here. Some were brought in as medicinal plants when early settlers came over from Europe. Some were brought in as garden flowers and have escaped from cultivation. Some came in as weed seeds in boatloads of grain. Perhaps some were carried in pants cuffs, or luggage, or in the straw used for packing fragile objects. How many ways can you think of that foreign plants such as dandelion, chicory, yarrow, the two most common thistles, and burdock might have come into our country?

A composite that is not pretty and has no fragrance, but is one of our most important weeds is *ragweed*. You may wonder why it is so important if it isn't pretty and it isn't fragrant. It is one of the most serious causes of hay-fever. Perhaps you know of someone who suffers from hay-fever. He may tell you that ragweed is the most important (and the most despised) plant in the whole world!

The flowers of ragweed do not look like other composite blossoms. They are green — not brightly colored—and so tiny that you will need a magnifier to see the florets. The male flor-



Frenchweed would make a short game of "she loves me. . ."

ets grow in small heads near the top of the plant. Each head is enclosed in an inverted saucer-shaped involucre attached to the stem. The picture on page 20 shows you what these male heads look like. The stamens of these male florets produce the pollen that causes the running noses and red eyes of hay-fever victims.

The female florets grow in the axils (forks) of the leaves and branches lower down on the stem. These flowers, like the male flowers, are small and inconspicuous. Unlike most com-

posites, there is only one female flower to a head, although three or four heads may be found in an axil. The ragweed is an annual and so produces seeds each year that carry it over to the next year. In order to do this, its fruit-making ability must be efficient. Can you see why having the male florets above the female florets helps to pollinate the female florets? Do you think that insects would be attracted to ragweed flowers as they are to goldenrod or thistle blossoms? Sniff the flowers of ragweed to see if they have any fragrance. Can you detect any? If the florets are inconspicuous and have

no noticeable fragrance, how do you think they are pollinated? Do you know of any other plants that are pollinated like this?

Some newspapers carry the daily ragweed pollen count in a small item called the "sneeze-meter." This daily record is of interest to those who suffer from hay-fever. The count is made by exposing a greased glass plate to the air each day. A microscopic examination of this glass plate shows how many ragweed pollen grains have fallen on it. The scientists then use this figure to determine the number of pollen grains in a cubic meter of air on that day. This is the "pollen count" shown in the paper during the hay-fever season.

Most of what you see above ragweed's leaves are male flowers



White snakeroot is a beautiful white fall composite that you may find along woodland borders. Unfortunately, its beauty is no indication of its character, since it is poisonous to livestock that eat it. The tiny florets are all disc flowers, containing both stamens and pistils. Its leaves grow opposite each other, and frequently harbor a tiny leaf miner that makes snaky tunnels through the leaf. The larva becomes a tiny moth in the spring. Can you find some of the leaves of white snakeroot that show the leaf miners' work in them? Perhaps



White snakeroot is bad for livestock, but not for the tiny leaf miner that tunnels in its leaves

you can even find the tiny groups of castings (called frass) that the larvae leave here and there in the tunnels.

The fruits of the white snake-root, like those of goldenrods and asters, are borne away on the fall breezes, each on its pappus. Look for the flowers of this attractive weed, or for the fruits that give the smoky appearance to their heads.

Fleabanes are aster-like composites that often grow with goldenrods and asters along roads and in fields. They have much more slender ray florets than do the asters, and usually many more of them. The ray

flowers are white or pale pink, and the disc florets are yellow. The name comes about from a supposed ability to keep fleas away—a doubtful ability. It is not a bad weed, is fairly easily controlled by plowing or pulling, and is not aggressive enough to crowd out other well-established plants. Look for some fleabanes that are in fruit. Is there a similarity between their fruits and those of other composites?

Yarrow is another composite that came over from Europe. Its white florets are so tiny that you might not recognize it as a composite at all. There are few disc florets in each head, and fewer ray florets. Both fertile ray and disc florets can produce fruits.



Fleabane's many ray florets would make a long game of "she loves me. . ."

have a word to describe such a leaf condition. It is *perfoliate* and means that the stem goes through the leaf. Can you find any other plants with leaves like this?

Because boneset and Joe-pye-weed grow in wet or poorly drained soils, you can tell at a glance what the drainage is like where they grow. Suppose you and your family were looking over some prospective building sites for a new home. Suppose on one site you saw a clump of Joe-pye-weed or boneset growing. Would you want a house with a basement on this site? Do you think that even if a cellarless house were built on this ground, its septic tank would function well? Why? Plants are often indicators of what lies at their roots. Hawkweed, as you read, tells of poor soil. Joe-pye-weed and boneset indicate wet soils. Can you learn about any other fall weeds that tell you something about the soil around them?

Composites of the Garden

You have read about and studied some of the composites that grow in the fields, along the roadsides, and in woodland borders. These are not the only composites that are to be found in blossom in fall. Perhaps in your

own garden you can find numerous composites such as dahlias, chrysanthemums, asters, marigolds, zinnias, and calendulas. A few of these beautiful flowers are not hardy and die back with the first killing frost. Zinnias and calendulas, for example, may show the effects of cold nights as early as the first of October. Some asters and chrysanthemums are hardy plants, often blooming long after other flowering plants have been killed by frosts.

Among the garden composites you will find all three types of floral arrangements: ligulate heads, discoid heads, and radiate heads. Some of the double asters and the chrysanthemums have been cultivated for their showy ray florets until they have lost nearly all traces of disc florets. Most of their ray florets are sterile ones, so they usually are

Joe-pye-weed and boneset grow in profusion in the moist soil along this stream bank





Some persons confuse yarrow with wild carrot, but you shouldn't

It is easily recognized because of its finely cut leaves. Some persons used to call yarrow "blood-stanch" because of the ability of its juices to help stop the flow of blood. Legend tells us that Achilles (for whom the genus is named) used yarrow or one of its relatives to treat Telephus' wounds. Perhaps you can find other legends about the medicinal properties of such composites as yarrow.

In wet fields and poorly drained soils you may see the purplish heads of *Joe-pye-weed*. Later in the fall, the heads will appear smoky-colored because of the tufted fruits. The heads contain a few bright purple, fra-

grant disc florets. I have often seen humming birds hovering about the sweet-scented heads of *Joe-pye-weed*. In favorable sites, this weed grows to a height of four or five feet. It is not found in dry soils, so you may be sure that where *Joe-pye-weed* grows, the water table is not far below the surface of the soil.

The odd name of this weed comes from a legend about an Indian named Joe Pye, who used this weed for all sorts of medicines, including a cure for typhus fever that occurred among the early Massachusetts settlers. Whatever its supposed medicinal qualities, it is a weed of beauty and fragrance in the early fall countryside.

Often growing with or close to *Joe-pye-weed* is *boneset*, another weed that supposedly gets its name from some ancient use as a potion or poultice. The florets of *boneset*, like *Joe-pye-weed* and white snakeroot, are all disc florets, and all can produce fruits. The leaves of *boneset* are odd because the stem appears to go right through them. The leaves grow opposite each other, but the base of the leaf on one side joins the base of the leaf on the other side so that the two leaves appear to be one. Perhaps you noticed that the leaves of teasel are much the same. Botanists



Black-eyed Susan, unlike most radiate composites, has black disc florets

the corn. It grows to fantastic heights, often reaching far over your head. It is a radiate composite, with yellow ray florets that are sterile (do not produce fruits). The disc florets, however, produce large fruits, each with a single seed. Sunflower seeds are very popular bird food—especially for chickens and cardinals. The fruits are formed in great masses in the disc, each with an inadequate little pappus that falls off early as if discouraged at the burden it was supposed to bear away on the breeze. If the seeds are not collected or eaten by eager birds they are shaken out of the head by the late fall gusts, and scattered far afield.

You may purchase sunflower seeds in quantity during the win-

ter to use as bird food. If you have never tried feeding winter birds, you must do so this winter. *Inviting Bird Neighbors*, 4-H Club Bulletin J-103, will tell you how to make a bird feeder for your back yard. Stock it with cracked corn and sunflower seeds and you will have a constant stream of feathered visitors to your yard. Watch how the cardinals deftly husk the sunflower seeds with their stout orange-red bills. You may decide that you would like to plant some sunflower seeds next spring and grow your own bird food. If you do so, before summer is over one of the largest and most beautiful of composites will look down at you.

As you observe and enjoy the fall garden composites, look closely to see how their florets

The sunflower, our largest radiate composite, is truly gigantic compared to the tiny Frenchweed



grown from cuttings rather than seed. Even those that do produce seed are frequently grown from cuttings. The plants are perennials, and can be separated into several sections as they grow greater numbers of stems.

A few garden composites such as *ageratum* have only disc florets. (What weeds and wildflowers have only disc florets?) *Ageratum* is usually a beautiful blue that is often grown to contrast with the yellows and oranges of marigolds and zinnias. Its name means "not growing old," implying that the plant blooms all summer and fall. As with many of our composites, this plant is not native to New York State, but was introduced from tropical America. Do you remember reading about a weed that came from the same area (page 18)?

Several species of thistle are grown in gardens for their beauty and their fragrance. (If bull thistle had a less discouraging involucre, I am sure it would be a popular garden flower.) Some are pale purple. Others are more

nearly pink. All of them are discoid like the wild thistle.

Black-eyed Susan is a favorite of many gardeners, and has even escaped to grow wild in fields. This hardy composite has both ray and disc florets. Susan's black eye is a cushion of fertile disc florets, but the yellow or orange ray florets are sterile as in many radiate composites. If you examine the brown and yellow blossoms with a magnifier you will easily see the difference between the two kinds of florets.

You saw *yarrow* growing in the fields. Some species of yarrow are grown as garden flowers. Wild yarrow is white, but the cultivated yarrow may be yellow, pink, or white. If you can recognize the yarrow of the fields, you will certainly recognize the yarrow of the gardens, since the cultivated species have similar floral structure and leaves. Gardeners may not call the plants "yarrow." This sounds too weedy. Instead, they may use the genus name, "*Achillea*." Do you remember where that name came from (page 22)?

Perhaps the largest of the garden composites, or of the wild composites, too, is the *sunflower*. You may see it growing in a vegetable garden, in a flower garden, or even scattered among

Some marigolds have conspicuous disc florets; others do not



others. Many of them are beautiful and fragrant and well worth your curious examination.

High, coarse, and yellow is the flowering stalk of *mullein*. You may have seen the tall brown stalks standing straight up from the wooly base in dry fields or road-cut banks. The flowers are bright yellow, but only a few at a time blossom on the long flowering stalk, often more than a foot long. The blossoms flower from the bottom of the flowering stalk toward the top. Early in the fall you may see a yellow flower a foot or more down from the tip. Later, a yellow flower may be seen part way up the stem, and still later, near the top. By maturing a few flowers at a time, mullein may blossom from July right through September and into October. Because it is a biennial, the seeds that form this fall, will grow into flat, wooly rosettes by next fall, but the plants will not produce seeds until the following year.

In contrast with the giant mullein, there is a common plant with tiny, almost invisible flowers, that blooms all summer and fall. It is almost sure to grow along your walks, or on the paths across the park, or along your driveway. *Knotgrass* will grow where there is enough traffic to

discourage less hardy weeds. Its flowers, less than $\frac{1}{8}$ " in diameter, are hidden among the axils of the leaves. If you look closely at a piece of the plant you are almost sure to find the pinkish-white blossoms along the stem. Each flower has five petal-like sepals, and each flower produces a single fruit. Small birds that feed on the fruits help to spread the plant. A single plant can also cover a large bit of ground during its long growing season.

Knotgrass belongs to a large family of plants called the buckwheat family. Its scientific name means "many knees." You can see for yourself how the plant family got this name if you run your thumb and forefinger along a bit of the stem. Can you feel the little bumps or "knees" at the nodes (places where leaves join the stem)? Look at a node with a magnifier. Can you see a thin, membranous covering over

Hundreds of persons walking along this path did not discourage the hardy knotgrass, a section of which is shown enlarged





Most dahlias do not show their fertile disc florets as this one does

are arranged. Examine the involucre that helps to support and protect the head. When fruits begin to form in the heads, watch how it is done. Examine the fruits after they have formed. Try to picture in your mind where each part came from and what may be its function. You will find that the composite head is not so complicated after all. It is a thing of beauty and order—one of the real masterpieces of Nature's flowergarden.

As you use your eyes to study the composites, use your ears, too. If the day is sunny and calm when you visit the fields or the garden, stand still and close your eyes for a minute. Can you hear the steady hum of the traffic on

"composite street?" The bees and the flies are busy searching for hidden nectar among the florets. You can imagine what it must be like to be a bee on a goldenrod blossom if you will picture yourself with a straw for a mouth, and several cases of pop bottles containing your dinner, but only a drop or two of it in each bottle. Wouldn't you be busy if you had to visit each bottle, getting a drop from this one, a couple of drops from that one, another drop from the next one? Each bottle would represent a floret, each case a flower head, and goldenrod has many heads on each stem. That's what keeps the bees and flies so busy. You may watch them without fear of being stung because they are too busy probing the fall flowers to pay much attention to curious observers such as you and me.

Composites Aren't All

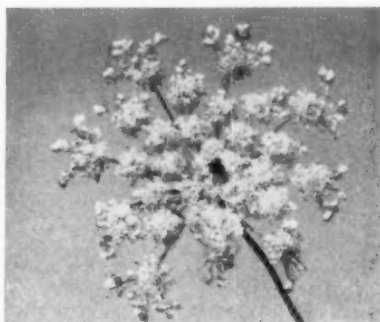
The composites are certainly the most numerous and probably the most showy of the fall flowers. They are far from being the only plants in blossom in fall, however. An examination of your schoolgrounds, or your yard and garden, or the fields and woodland borders near your home is sure to turn up many

(Doesn't the umbel or the umbellet make you think of a miniature umbrella? The words have the same origin.) The outer flower clusters of each umbellet are larger than the inner ones, so that a white medallion with a beautifully proportioned border is formed. At the base of each umbellet are several bracts that might suggest an involucre, and this is repeated in larger scale at the base of the umbel. In the very center of the medallion there is often a single, large, dark purple floret. It is not known why this floret is so different from the rest, but if the umbel represents a medallion of Queen Anne's lace, then this must be a priceless ruby set in its midst.

By late fall few wild carrot blossoms are to be seen. Instead, there are hundreds of "bird-nests" where weeks before there had been medallions of lace. The fruits of this attractive weed are tiny burs that bear some resemblance to the burs of burdock. Remember, though, that a burdock bur is a whole head of fruits, but a wild carrot bur is a single fruit. They are easily carried off by passing animals, or shaken loose and scattered across the snow on the winter wind. Like teasel, this weed is a biennial, so this year's fruits

will grow only inconspicuous rosettes next year, but more fruits the year after that.

Other fall flowers that you will see if you look carefully as you walk or ride are butter-and-eggs, musk mallow, and sorrel. These are really late summer plants, but often bloom well into September. *Butter-and-eggs* looks like small, yellow snapdragons on a pale green, slender stem. Indeed you can pinch open the mouths of these little yellow dragons to see the floral parts inside. The petals of these attractive flowers have been changed through the ages until there is really only one tubular petal with an upper and lower lip. In this simple flower you can find a calyx (the sepals), petals (fused into one), stamens and a



Near-perfect symmetry is exhibited by the white medallion of Queen Anne's lace

the node? This tells you that the plant belongs to the buckwheat family. Look for some knotgrass as you walk to and from school. What is the farthest that you can find the weed growing out over the sidewalk? Of course it cannot take root in concrete or blacktop, but it certainly reaches far out over both surfaces.

Red clover blossoms in many fields and roadsides until late fall. As with thistles and burdock, its flowers are long and tubular, with many on a head. (Can you tell why red clover is not a composite?) The nectaries are at the base of these tube-flowers, so only insects with long tongues can reach them. Bumblebees have long tongues that are just right for sipping nectar from the red clover blossoms. In fact, bumblebees are the most important visitors to the red clover blossoms because they pollinate the flowers at the same time they gather the nectar. Charles Darwin, who taught us much about how living things are always changing, once said that housecats might determine the numbers of certain flowers. His reasoning has been used to say that "the old maids of England are the backbone of the British army." Here's why:

Old maids keep cats;
Cats eat meadow mice;
Meadow mice leave empty
holes for bumblebees to nest in;
Bumblebees pollinate red clover.
Beef cattle eat red clover.
Soldiers eat beef.

So, old maids are the backbone of the army.

This may be far-fetched, but it does show that many years ago it was recognized that bumblebees and red clover were partners in an important relationship.

One of the most widespread and most easily recognized of all fall flowers is *wild carrot*, or *Queen Anne's lace*. It is a weedy weed that came to us from Europe. So stubborn and unwanted a weed it is that Mrs. Comstock jokingly suggested that "there should have been established in America such a high tariff on this royal fabric as to have prohibited its transportation." Nevertheless, it is with us and is bound to stay for a long time.

If you can forget for the time being what a bad weed wild carrot is, you will see in its blossom one of Nature's truly beautiful creations. The flower structure is called an *umbel*, and on each "spoke" of the umbel is a smaller umbel or umbellet.

approaches, and the fruits are full-grown and ripe, the husks open, and squeeze the nuts so hard that they are hurled away with considerable force. Measurements of over 40 feet have been reported for this feat.

Some Other Things to Look For in Fall

You have been reading about the flowers that you can see in fall. There are many, many flowers that you cannot see, but which are all around you in fall. These are the flowers that are enclosed in the tightly-packed flower buds of trees and shrubs. *Fall Changes*, the Leaflet for fall, 1954, described these buds. They begin to form early in the summer, grow throughout the summer, and by early September are fully formed. In these buds the flowers pass the winter—dormant, but alive and ready to open next spring when the moisture and temperature are right. Look for these buds. They are mosque-shaped on flowering dogwood, clustered at the tips of the maple twigs, and hidden in pairs in the leaf axils of spicebush. They are large and sticky on horsechestnut. They are almost invisible on staghorn sumac. Perhaps your teacher can



You may find witch hazel in blossom even after snow covers the ground

help you find some of the flower buds that would open next spring or early summer.

Under the trees and shrubs, all through our lawns, and covering many acres of meadowland and pasture is another flower that you probably didn't even think of. It is *grass*—all kinds of grass. Kentucky blue grass, the kind that many lawns are made of, blossomed in late summer and early fall, but its flowers were green and didn't show up as did the asters and daisies. You would hardly say that grass flowers are not important, though, would you? Remember that it is from their flowers that we get the seed to sow our lawns and fields. Many grasses have now gone to seed, but the lawn grasses still flower in fall. You can probably find some on your

pistil. How different this is from the composite blossom!

Musk mallow has a pink or white blossom that looks like a small edition of the hollyhock. Its blossom is 1-2 inches across, has a large calyx behind it, and numerous stamens and a pistil among the petals. It is a frequent roadside plant, and lends a pleasant color to a late summer or early fall drive through the countryside.

Sorrel, often called sour-grass, has a leaf that many persons mistake for clover. Its blossom is yellow, and is often hidden among the taller grasses in which it grows. The leaves of sorrel have a salty-sour taste that gives the plant another common name, "lost hunters' salt." Try chewing some of the leaves. Can you taste the salt in them?

It isn't really salt, but a chemical that reacts to cause a taste something like salt.

One of the latest fall flowers to bloom in New York State (except for those greenhouse-regulated ones such as poinsettias and chrysanthemums) is not an herbaceous plant at all, but a shrub. After the maple leaves have "caught fire" and dropped, *witch-hazel* opens its yellow flowers. Each flower has four strap-like petals that curl and twist after opening. In the center of the flower is a two-celled pistil that encloses the young nutlets. After the stamens have discharged their pollen, and the tiny young nutlets begin to grow, the petals fall and leave the calyx to form a cup for the fruits. It takes a whole year for these fruits to mature. Then when fall

Musk mallow (left), *sorrel*, and *butter-and-eggs* (right) are early fall flowers of fields and roadsides, but blossom much later in protected places



own home lawn or at school. Look at them with a magnifier. Can you find the stamens? They quiver in the slightest breeze, and there are many of them on each head of grass. The pistils are more difficult to find, but you may recognize the fuzzy stigma that projects from among the bracts of the head. The flowers of grass come in an amazing variety of arrangements. Their beauty lies, not in their color or their fragrance, but in the amazing structure that insures polli-

nation without the help of insects.

Fall, then, is not the bleak and frosty season that some persons would have us believe. It is a season of promise, not of farewell, for the flowers themselves are the very agent by which we may enjoy the purple and gold another year. The fruits the flowers leave behind are a deposit in the bank of botany. Enjoy the flowers. Study them as you enjoy them, and fall may well become your favorite season as it is mine.

Some Books That Tell About Fall Flowers

Fall Is Here by Bertha Parker. Row, Peterson and Co., Evanston, Illinois. 1950. 36 pages. A few pages show the flowers and fruits that children can find in fall, in addition to other evidences of the season. Primary.

The True Book Of Weeds And Wild Flowers by Illa Podendorf. Children's Press, Chicago, Illinois. 1955. 47 pages. Several pictures of fall flowers are included in this generalized account of flowers. Primary.

What Wildflower Is It? by Anna Pistorius. Follett Publishing Co., Chicago, Illinois. 1950. 25 pages. Colored illustrations and brief descriptions include several of the common fall flowers. Intermediate.

"Goldenrods And Asters" by E. L. Palmer. *Nature Magazine*, August-September, 1956. Pages 361-368. Sketches of several species of fall composites are accompanied by an informative text. Intermediate, upper.



Cooperative Extension Service, New York State College of Agriculture at Cornell University and the U. S. Department of Agriculture cooperating. In furtherance of Acts of Congress May 8, June 30, 1914. M. C. Bond, Director of Extension, Ithaca, New York.